

Acta vet. scand. 2001, 42, 181-187.

# Cubicle Refusal in Norwegian Dairy Herds

By H. P. Kjæstad<sup>1</sup> and H. J. Myren<sup>2</sup>

<sup>1</sup>The Norwegian School of Veterinary Science, Department of Large Animal Clinical Sciences, Oslo, and <sup>2</sup>1760 Berg i Østfold, Norway.

**Kjæstad HP, Myren HJ: Cubicle refusal in Norwegian dairy herds. Acta vet. scand. 2001, 42, 181-187.** – In order to survey the behaviour of choosing the alley area instead of a cubicle as a lying place (cubicle refusal), a questionnaire was sent to the 273 dairy farms in Norway known to keep cows in cubicle housing systems. Sixty-six percent of the farmers contacted were included in the study. The median herd size was 18 cows (range 7-118). More than 85% of the herds had sheds providing one or more cubicles per cow. The mean herd occurrence of cubicle refusal was 6%, but showed great variation (range 0-55%). Regression analysis showed a significant association between rearing heifers in slatted floor pens and an increased cubicle refusal occurrence ( $p=0.02$ ,  $R^2=0.05$ ), while herd size, use of litter, or cubicle-to-animal ratio were not found to be associated with cubicle refusal. The practice of rearing heifers in slatted floor pens accounted for about one half of the observed cubicle refusal (etiologic fraction=0.51).

*dairy cows; cubicle housing; cubicle refusal; rearing accommodation.*

## Introduction

Dairy cows are mainly kept either individually tethered in stalls or in non-confinement housing systems. Non-confinement dairy housing originally did not provide individual lying spaces, but was further developed by the introduction of the cubicle (Nein 1961, Bramley 1962). Rising labour costs during the last decades has led to cubicle housing becoming the favoured system for keeping large dairy herds. Additional benefits of such housing systems, such as allowing the cows to express a broader pattern of behaviour, have led to its more general acceptance and have contributed to many cubicle sheds being also erected in countries in which herds are generally of medium or small size. In Norway, there are examples of such sheds for herds as small as 8 cows (Bøe 1993). Some early reports on installing cubicles in loose housing sheds claimed that this significantly reduced the need for bedding, reduced labour costs, and resulted in cleaner and gentler

cows and fewer teat and udder injuries (Estep *et al.* 1962, Huber & Ewalt 1962, Zantow 1962). However, it was also found that some cows refused to use the cubicles and chose to lie down in the alley or dunging area (Estep *et al.* 1962). This behaviour still seems to be relatively common, as one can frequently hear it described by farmers as well as practising veterinarians. The behaviour of partly or fully lying down outside a cubicle, hereafter referred to as cubicle refusal, is highly undesirable. It leads to contamination of bellies and udders with faeces and urine, which is detrimental to milk parlour hygiene, and which may ultimately lead to impaired milk quality because of bacterial contamination of the milk (McKinnon *et al.* 1983, Lunder & Brenne 1996). The added necessity to thoroughly clean the udder increases the labour associated with milking. Furthermore, it is an established fact that some faecal bacteria, for instance *Escherichia coli*, are potential udder

pathogens (Bramley & Dodd 1984). It is therefore likely that the increase in pathogen density associated with faecal soiling of the udder surface may increase the risk of mastitis. There is also the chilling effect on the udder, due to moisture on the udder surface as well as to drafts through the slatted floor (when the cow is lying down). It has been shown experimentally that chilling of the udder increases the risk of clinical mastitis (Dyrendal & Ewbank 1968), presumably due to decreased local immunological resistance. This factor therefore further increases the overall risk of mastitis in cows which choose to lie down in the alley. Finally, the cows lying in the walking areas may hinder their herd-mates from moving about e.g. from cubicles to feeding table.

Although results from Belgian and Irish studies (Daelemans *et al.* 1981, O'Connell *et al.* 1993a) indicate a cubicle refusal occurrence of approximately 5% to 8%, this figure does not necessarily reflect the situation in Norway, because of differences in management practices, housing design and herd size.

A study was undertaken with the following aims:

- To estimate the occurrence of cubicle refusal in herds housed in cubicle sheds
- to investigate whether cubicle refusal is associated with housing and management factors, such as heifer rearing accommodation, herd size, the amount of litter applied to the cubicles, and the number of cubicles per animal in the herd.

### Materials and methods

The study was performed as a survey based on a questionnaire. With the assistance of the regional agricultural authorities, as well as local veterinary surgeons, a list of dairy farms with cubicle sheds was elaborated. The final list included 273 farms, these comprising all the farms in Norway employing a cubicle housing

system that could be identified by our methods at that time (1989).

The questionnaire was mailed to all the farmers identified, who were requested to provide the following information pertaining to cubicle use:

- Herd size, i.e. the total number of heifers and cows present in the cubicle-housed milking herd at the time of completing the questionnaire
- number of cubicles available to the milking herd at the time of completing the questionnaire
- number of individuals showing cubicle refusal at the time of completing the questionnaire. Cubicle refusal was defined as the habit of usually lying down with the body completely or partly in the alley area instead of in the cubicle according to 4 mutually exclusive, predefined categories:
  - Consistent cubicle refusal with entire body
  - occasional cubicle refusal with entire body
  - consistent cubicle refusal with part of body
  - occasional cubicle refusal with part of body.

*Consistent* refusal was defined as occurring when a cow was observed never to fully use the cubicles. *Occasional* cubicle refusal was defined as existing if the farmer had seen the cow lying fully inside a cubicle from time to time.

- Type of heifer rearing accommodation (tethering, fully slatted pen, pen with cubicles, at pasture or other)
- an estimate of the amount, expressed in litres, of litter added to each cubicle per week
- a response to the question "How do you view cubicle refusal in your herd?". The response was to be given as a score on a scale from 1, "no problem" to 4, "a serious problem". The farmer was also requested to state in his own words which measures had been taken to prevent or stop the behaviour. Free text fields were also available for other comments.

The questionnaires were mailed to farmers during January, 1989, and all replies included in the study were received by January 1990.

### Statistics

The *occurrence* of cubicle refusal was defined as the proportion of cows in the actual milking herd which showed the behaviour. To test associations between cubicle refusal occurrence and housing/management factors, a multiple linear regression analysis was performed using the total herd occurrence, i.e. proportion of cows showing any kind of cubicle refusal as the dependent variable (abbreviated CREF). The following housing/management factors were used as independent variables:

- Rearing accommodation of heifers prior to transfer to the milking herd (abbreviated SLAT), “1” denoting fully slatted pen, “0” denoting the other types of accommodation
- the cubicle-to-animal ratio in the milking herd at the time of completing the questionnaire (CAR)
- number of animals in the milking herd at the time of completing the questionnaire (HSIZE)

- the farmer’s estimate of the amount of litter added per cubicle per week (LITTER).

The variables were included in a multiple linear regression analysis as the initial model  $CREF = a + b_1SLAT + b_2CAR + b_3HSIZE + b_4LITTER$ ,  $a$  being the regression constant (intercept) and  $b_n$  the regression coefficient of variable number  $n$ . Fifty-five herds missed data for one or more of these variables, leaving 131 herds eligible for analysis. The analysis was run by adding and/or removing the independent variables to/from the initial model one at a time, finally including only those which were statistically significant. The criteria for entry and removal of variables used were  $p(F) < 0.05$  and  $p(F) > 0.10$  respectively (SPSS Inc. 1993). The etiologic fraction (EF) was calculated according to the formula  $EF = \frac{RR-1}{RR} \times f$ ,  $RR$  being the relative risk of cubicle refusal,  $f$  being the rate of cubicle refusal among cows from herds practicing rearing in slatted floor pens (Ahlbom & Norell 1987).

### Results

Replies were received from 184 farms (67%). In some instances farmers did not provide all

Table 1. Occurrence of cubicle refusal in dairy herds. The four refusal categories were mutually exclusive so that a cow could only be included in one category. The figures calculated for each herd for all four categories combined are given as the “total”.

Behaviour category	In all herds (N = 184)			In herds with cubicle refusal (N = 100)		
	Mean	Range	S.D.	Mean	Range	S.D.
Consistent cubicle refusal with whole body	2%	0-28%	4	4%	0-28%	5.6
Occasional cubicle refusal with whole body	3%	0-26%	5	5%	0-26%	5.8
Consistent cubicle refusal with part of body	1%	0-20%	3	2%	0-20%	4.0
Occasional cubicle refusal with part of body	1%	0-22%	3	1%	0-22%	3.3
Total cubicle refusal in herd	6%	0-55%	9	12%	1-55%	8.9

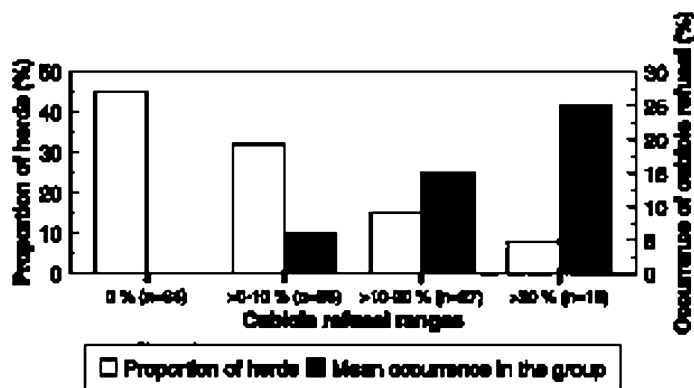


Figure 1. The occurrence of cubicle refusal among the studied herds.

the information that was requested, this resulting in complete records concerning the 5 variables tested in the statistical analysis being available for only 131 herds.

The median herd size was 18 cows (range 7-118,  $N=184$ ). More than 85% of the sheds were fitted with one or more cubicles per cow ( $N=176$ ). About 20 l of litter was the amount usually added to each cubicle weekly ( $N=164$ ). In 127 (69%) of the 184 farms, the heifers were accommodated in fully slatted pens before transfer to the milking herd. In 12 farms (7%), the heifers had been kept in pens, but with access to cubicles. Tethering of heifers was practised in 16 farms (9%), while in 25 farms (14%) the heifers were transferred directly from pasture to the cubicle shed. In this latter case, the previous accommodation of the heifers was not known. The remaining farmers did not provide any information regarding heifer accommodation.

The mean herd occurrence of cubicle refusal was found to be 6% (Table 1), and the range was wide (0-55%). A large proportion of the herds (45%) had no cubicle refusal, while a few farms showed occurrences of 20% or more (Fig. 1). When considering only the 100 farms which reported to have the behaviour, the mean occurrence was 12% (Table 1).

The regression analysis resulted in the following model

$$\text{CREF} = 2.8 + 5.00 \times \text{SLAT},$$

indicating that the accommodation of heifers in slatted floor pens (SLAT) was the only variable significantly associated with the occurrence of cubicle refusal (CREF),  $p=0.02$ . This model accounted for 5% of the variation in the cubicle refusal occurrences in the herds ( $R^2=0.05$ ). Rearing accommodation's etiologic fraction of cubicle refusal was 0.51 (c.i.<sub>95%</sub> = 0.19-1.00). The variables for cubicle-to-animal ratio ( $p=0.50$ ), herd size ( $p=0.34$ ), and the amount of litter added per cubicle per week ( $p=0.93$ ) were not found to be significantly associated with cubicle refusal.

Information on the extent to which cubicle refusal was viewed as a problem was provided by 182 farmers. None of them considered cubicle refusal to be a serious problem in their herd. Nevertheless, 66 farmers had at times taken measures to prevent cubicle refusal, the most common of which was to tie up problem animals in a cubicle overnight. Furthermore, it was stated by some farmers that cubicle refusal was most common among heifers after transfer into the milking herd, but also that most heifers started to use the cubicles within 2 weeks. Some farmers stated that cubicle refusal was

more frequent during the period just before and after calving than at other times.

## Discussion

Although there was a considerable degree of non-response from the farmers included in the present study, we do not believe that failure to return the questionnaire or fully complete the returned forms was systematically associated with factors relevant to the requested information. It should also be borne in mind that the initial list of farms encompassed the entire known population of cubicle-housed dairy cows in Norway, and that the descriptive and analytical results therefore were based on replies from, respectively, 2 thirds and one half of the total number of farms. Although a lower non-response rate is preferable, it is below the 70% which, according to *Thrusfield* (1995), is the maximum acceptable non-response rate for mailed, self-completed questionnaires.

Variation in the farmers' ability to accurately record the behaviour of the cows in their herds was a potential source of error. We sought to reduce this variation by defining the behaviour categories as unambiguously as possible so that the recordings would not be influenced by the observer's *a priori* knowledge of cattle behaviour.

The mean occurrence of cubicle refusal found in this study is in accordance with results obtained in similar studies performed in Ireland (*O'Connell et al.* 1993a), Belgium (cited in *Daelemans* 1981) and Germany (*Bock* 1990). The occurrence of cubicle refusal was found to be between 4.3% and 8% in all 3 studies even though the observation methods probably differed. The observation methods used in the 2 first cited studies are not described, whereas in the German study, cubicle use was observed in a more detailed manner than in the present study. However, the similarities between the results obtained in studies performed in different

countries with different management systems, different herd sizes, and at different times, lead us to the conclusion that although levels may vary greatly between herds, the average occurrence of cubicle refusal is relatively constant in the total population. *Zeeb* (1985) has proposed that in a cubicle shed, a cubicle refusal occurrence of <10% can be characterised as "good", 10-20% as "problematic" and >20% as "not advisable". *Bock* (1990) reviewed some of *Zeeb's* proposals, and concluded that no more than 5% cubicle refusal would occur if certain requirements, such as correct cubicle dimensions, were met.

It was found in the present study that 55% of the herds had at least one problem animal. The figure is lower than in the survey of *O'Connell et al.* (1993a), in which 77% of the farms were reported to have one or more animals showing cubicle refusal. This apparent difference can be explained by the fact that the herds in the Irish study were larger than those included in this study, and that the chance of at least one animal showing cubicle refusal behaviour was therefore greater.

Keeping the heifers in slatted floor pens prior to transfer into the milking herd was significantly associated with more cubicle refusal in the herd than other kinds of accommodation, such as individual tethering. Any effect of rearing accommodation is likely to be most pronounced on those individuals with the most recent experience of that environment, i.e. the heifers and first lactation cows. Our material, and analysis, also included the older cows in the herd, which may have caused underestimation of the effect of the rearing environment factor, hence the small  $R^2$  value (0.05). However, the EF value suggests that about 50% of the cubicle refusal in the material may have been prevented by changing rearing practices, a strong indication of its practical significance. The association is supported by *O'Connell et al.* (1993a), who

find that herds with slatted floor accommodation of heifers are more affected by cubicle refusal than herds in which heifers are housed in other ways. The cited authors report further evidence of this association from an experimental study (O'Connell *et al.* 1993b) in which 3 groups of heifers, each group accustomed to a different rearing environment, were moved to a cubicle shed. They find cubicle occupancy levels after transfer to be lowest in the group of heifers which was reared in a fully slatted pen, and highest in the group reared in a pen which was similar except for being fitted with cubicles.

Several authors show that creating a situation of overcrowding, i.e. providing less than one cubicle per cow, tends to diminish cubicle use in terms of lying time (Friend *et al.* 1977, Kaiser 1974, Wierenga & Hopster 1990). In the present study, no association was found between the cubicle-to-animal ratio and the occurrence of cubicle refusal. This may be explained by the fact that there was little variation in the material, and that the vast majority of farms provided one cubicle or more per cow.

O'Connell *et al.* (1993a) compared lying-out levels in farms of different sizes, and report more cubicle refusal in herds of less than 50 cows than in larger herds. Herd size was not found to be significantly associated with cubicle refusal in the present study. However, it should be noted that herd sizes in the 2 studies differ, as in the present study, most herds comprised less than 30 cows and in very few were there more than 50 cows.

In the present study, litter use was not a significant factor in the analysis of cubicle refusal. This was probably due to the small variation in litter use between herds, the application of litter anyway being fairly sparse in all farms. The litter that was provided did not serve the purpose of bedding as such, but rather had the function of absorbing moisture.

The subjective ratings by the farmers in the present survey showed that most of them considered cubicle refusal to be only a minor problem or no problem at all. All such subjective ratings would, however, have been relative to the severity of other housing or management problems that might have been present. Despite its apparent insignificance, many farmers introduced measures, such as tying cows up inside a cubicle, against refusal, which may indicate that they nevertheless regarded cubicle refusal as a problem. The eventual effect of those measures is not known. However, achieving permanent behaviour change may be difficult. Albright *et al.* (1988) tried to modify the behaviour of cows which showed undesirable lying behaviour, e.g. refusing cubicles or lying backwards in the cubicles. They attempted this by confining cows in cubicles as well as giving them an electric shock with a prod when they were caught showing the undesirable lying behaviour. Most of the cows nevertheless reverted to their adverse behaviour shortly after the trial ended.

We conclude from the present study that cubicle refusal seems to constitute only a minor problem in the cubicle-housed dairy population as a whole in Norway, but that a few herds are more severely affected, and that, furthermore, the problem is associated with the way in which heifers are kept prior to introduction in the cubicle-housed milking herd.

### Acknowledgement

The authors wish to thank the Regional Agricultural Office of Østfold county for funding the survey. We also gratefully acknowledge the assistance of Dr. Egil Simensen, Dr. Arne Flåøyen, and Dr. Olav Østerås in preparing this manuscript.

### References

- Ahlbom A, Norell S: Grunderna i epidemiologi (the basics of epidemiology). Studentlitteratur, Lund 1987.

- Albright JL, Creel SR, Koons CW: Behaviour modification of cow refusal to use free stalls (cubicles) in dairy housing. *Appl. Anim. Behaviour Sci.* 1988, 21, 378-379.
- Bøe K: Synspunkter på adferd og produksjon hos melkekuer i løsdrifts- og båsfføssystemer (Views on behaviour and production of dairy cows in non-confinement and confinement housing). ITF report 28, Agricultural University of Norway, Ås 1993.
- Bock C: Zur Beurteilung tiergerechter Laufställe für Milchvieh. *KTBL - Schrift* 1990, 339, 1-82.
- Bramley M: 'Kow Kubicles'. *Farm Build. Ass. J.* 1962, 196, 69-73.
- Bramley AJ, Dodd FH: Reviews of the progress of Dairy Science: Mastitis control - progress and prospects. *J. Dairy Res.* 1984, 51, 481-512.
- Daelemans J, Maton A, Lambrecht J: The appraisal of some cubicle floors by cows. In: *Proceedings of the Commission Internationale du Genie Rural seminar, Aberdeen 1981. Farm Buildings Information Centre, Aberdeen.* 1981, pp 231-235.
- Dyrendal I, Ewbank R: An experimental demonstration of the effect of surface cooling upon the health of the bovine mammary gland. *Vet. Rec.* 1968, 84, 685-686.
- Estep A, Winters W, Davis E: Loose stall housing construction and management of dairy cattle. Report EM 2215, Washington State University 1962.
- Friend TH, Polan CE, McGilliard ML: Free stall and feed bunk requirements relative to behavior, production and individual feed intake in dairy cows. *J. Dairy Sci.* 1977, 60, 108-116.
- Huber MG, Ewalt HP: Individual stalls for dairy cattle in loose housing systems. Report FS8. Oregon State University 1962.
- Kaiser R: Untersuchungen zum Verhalten von Milchkühen im Boxenlaufstall bei unterschiedlichem Tier-Liegeplatz-Verhältnis und ständig freiem Zugang zur Krippe. *Die Tierzucht* 1974, 28, 187-189.
- Lunder T, Brenne E: Factors in the farm production affecting bacterial content in raw milk. In: *Proceedings of the seminar Bacterial Quality of Raw Milk, Wolfpassing 1996. International Dairy Federation, Wolfpassing.* 1996, pp 103-107.
- McKinnon CH, Fulford RJ, Cousins CM: Effect of teat washing on the bacteriological contamination of milk from cows kept under various conditions. *J. Dairy Res.* 1983, 50, 153-163.
- Nein RA: A "private bedroom" for each cow. *Hoard's Dairyman* 1961, 106, 741/755.
- O'Connell JM, Giller PS, Meaney WJ: A note on management practices and cubicle refusal in dairy cows. *Irish J. Agric. Food Res.* 1993a, 32, 83-86.
- O'Connell JM, Giller PS, Meaney WJ: Weanling training and cubicle usage as heifers. *Appl. Anim. Behav. Sci.* 1993b, 37, 185-195.
- SPSS Inc.: SPSS for Windows base system user's guide, release 6.0. Chicago 1993, 828 pp.
- Thrusfield M: *Veterinary epidemiology.* Blackwell Science, Oxford 1995, 479 pp.
- Wierenga HK, Hopster H: The significance of cubicles for the behaviour of dairy cows. *Appl. Anim. Behav. Sci.* 1990, 26, 309-337.
- Zantow E: Free Stall Housing. Report 62-924. American Association of Agricultural Engineers 1962.
- Zeeb K: Zur Beurteilung von Haltungssystemen für Rinder aus ethologischer Sicht. *Tierärztl. Umschau* 1985, 40, 752-758.

### Sammendrag

*Forekomsten av gangligging i norske melkekubesetninger med løsdrift.*

For å kartlegge forekomsten av at kyr ligger i gangarealet i stedet for i en liggebås (gangligging), ble et spørreskjema sendt til alle 273 bruk med melkeproduksjon og løsdrift en kjente til i 1989. Om lag to tredeler av besetningene ble tatt med i undersøkelsen. Gjennomsnittlig ble seks prosent av kyrne bedømt som gangliggere av bonde/røkter. Forekomsten varierte sterkt mellom besetningene, fra null til 55%. I en regresjonsanalyse ble det funnet at oppdrett av kviger i spaltegulvsbinge var signifikant assosiert med økt gangliggingsprevalens ( $P=0.02$ ,  $R^2=0.05$ ). Omtrent halvparten av gangliggingstilfellene kunne tilskrives denne faktoren (etiologisk fraksjon=0.51). Verken besetningsstørrelse, bruk av strø i liggebåsene eller antall liggebåser pr. ku var forbundet med gangliggingsforekomsten i materialet.

(Received October 15, 2000; accepted November 15, 2000).

Reprints may be obtained from H. H. Kjæstad, Department of Large Animal Clinical Sciences, P.O. Box 8146, dep., 0033 Oslo, Norway. E-mail: hans.p.kjaestad@veths.no, tel: +47 22 96 49 56, fax: +47 22 96 47 61.